

Pediatric Anaphylaxis: Allergic Reaction to Egg Applied to Burns

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A 13-month-old boy presented to triage at 9:00 AM after pulling a cup of hot tea onto himself 30 minutes prior to arrival. The patient had second-degree burns covering approximately 5% of his body surface area including portions of his neck, left arm, and anterior trunk. His parents reported that they rubbed egg on the burn at the time of the incident. (The family had recently relocated from Africa.) The patient's immunizations were up to date, he had no known allergies (except to milk), and his parents described him as a healthy child.

The patient's initial vital signs at triage were as follows: temperature, 35.6°C (96°F) tympanic; heart rate (HR), 134 beats per minute; respiratory rate (RR), 26 breaths per minute; and an oxygen saturation of 96% on room air. On physical examination, the baby was awake, alert, and crying with grunting respirations, but was consoled when his mother held him. When he was calm, he had clear breath sounds bilaterally and his respirations were even and unlabored. His skin was warm and dry, and he was well perfused. The ED nurse attached the patient to a cardiac monitor and noted a sinus tachycardia with a HR of 134 beats per minute. She started a peripheral intravenous line and administered morphine sulfate for pain control and wound debridement.

At 9:20 AM, as the ED nurse was debriding the wounds, she noted that the patient had a blood pressure (BP) of 46/33 mm Hg, a HR of 167 beats per minute, a RR of 24 breaths per minute, and an oxygen saturation of 94% on blow-by oxygen. Two intravenous fluid boluses of 20 mL/kg warmed 0.9% normal saline solution were initiated in rapid succession, warm blankets were placed on the baby, and the oxygen was increased to 5 L by mask. After the completion of the second fluid bolus, the patient

was noted to be less responsive, yet remained arousable. He had decreased peripheral pulses, a central capillary refill time of 4 seconds, a BP of 63/52 mm Hg, and a HR of 180 beats per minute. The nurse started a second intravenous line and initiated a third intravenous bolus of 20 mL/kg of normal saline solution.

Following the completion of the third bolus, the patient's cardiovascular status was unchanged, so the nurse initiated a dopamine infusion at 5 µg/kg/minute. Ten minutes after the infusion was started, the patient's vital signs were as follows: BP, 78/37 mm Hg; HR, 179 beats per minute; RR, 24 breaths per minute; temperature, 35.2° C (95°F) rectally; and an oxygen saturation of 99% on 5 L of oxygen. The dopamine was increased to 10 µg/kg/minute, and a fourth intravenous fluid bolus was administered. The physician ordered multiple laboratory tests and radiographs to rule out the possibility of septic shock or child maltreatment.

Thirty-five minutes after his arrival at triage, the staff noted hives on the infant's trunk and extremities; the patient continued to have a decreased level of consciousness. The nurse administered antibiotics, and the physician intubated the patient.

At 11:15 AM, the infant was transferred to the pediatric ICU. His vital signs upon admission were as follows: BP, 102/52 mm Hg; HR, 162 beats per minute; RR, 24 breaths per minute; and temperature, 35.8°C (96°F) rectally. After admission, the staff prepared the infant to undergo further diagnostic testing, including a lumbar puncture. He was medicated with propofol (Diprivan) for the procedure, and shortly thereafter, hypotension and hives again developed. Because one of the precautions to the use of propofol is a sensitivity to eggs or soy, it was recognized that the baby's symptoms could be related to an anaphylactic reaction from the egg that his parents had placed on his burns.

Overview

Food allergy is the most common cause of anaphylaxis in the United States, and the prevalence of food allergies is the greatest in the first few years of life.¹ Most common food allergens in childhood are milk, eggs, peanuts, tree nuts, and shellfish.²

The first issue that this case brings to light is how important it is to be aware of different cultural practices, including home remedies for burn treatment. While the triage nurse and other caregivers of this child knew the parents

had put egg on the burn and had asked if the infant was allergic to anything, no one initially made the connection between the egg and the patient's clinical signs and symptoms of allergic reaction.

This home remedy is a common practice, especially in some African cultures.^{3,4} In a retrospective study of the substances used to treat burns in communities in Nigeria over a 2-year period, investigators found that raw egg was the most commonly used first-aid home treatment for 51% of the patients.³ Also, egg may be used in combination with other substances, such as palm oil, sand, or gentian violet, all of which must be removed during burn debridement.⁴

Symptoms [of anaphylaxis] also can be biphasic and occur hours after the initial symptoms have resolved, even without another exposure. . . . These reactions should be considered when triaging a patient who has self-administered epinephrine at home for symptoms of anaphylaxis and who is now presenting to the emergency department, symptom-free.

Clinical manifestations

Anaphylaxis is a clinical syndrome that results from a systemic immunologic reaction occurring after exposure to an antigen to which the patient has been sensitized. Symptoms may occur within seconds of antigen exposure and persist until metabolism of the antigen is complete. The speed from exposure to the onset of symptoms is a good indicator of the severity of the reaction.² Our patient's hives, bronchospasm, hypotension, tachycardia, and loss of consciousness all are classic signs of anaphylaxis.

There are some specific differences in the presentation of symptoms of anaphylaxis in the pediatric population. Skin symptoms (hives, flushing, angioedema) and respiratory symptoms (bronchospasm or laryngeal edema) appear earlier in children, whereas cardiovascular symptoms (hypotension, tachycardia, or arrhythmias) and gastrointestinal symptoms (vomiting or diarrhea) often occur earlier in adults.⁵ Children who present with anaphylaxis usually are

in the first decade of life and have a history of atopic dermatitis, such as eczema.⁵

Pediatric doses of epinephrine should be given by the intramuscular or subcutaneous route at a dose of 0.01 mg/kg (0.01 mL/kg), with a maximum dose of 0.5 mg. . . . The 1:1000 concentration must be used for intramuscular or subcutaneous epinephrine administration.

Symptoms also can be biphasic and occur hours after the initial symptoms have resolved, even without another exposure. This later biphasic reaction can occasionally be more severe than the acute incident.² These reactions should be considered when triaging a patient who has self-administered epinephrine at home for symptoms of anaphylaxis and who is now presenting to the emergency department, symptom-free.

Treatment

A crucial issue that this case reveals is the importance of early recognition of and intervention for anaphylactic shock. Regardless of the severity of the anaphylactic reaction, the first-line treatment is administration of epinephrine and oxygen therapy. (The patient in this case did not receive epinephrine because the anaphylaxis was not recognized in the emergency department.) Pediatric doses of epinephrine should be given by the intramuscular or subcutaneous route at a dose of 0.01 mg/kg (0.01 mL/kg), with a maximum dose of 0.5 mg. Evidence exists that an effective blood level may be obtained more rapidly when the medication is administered via the intramuscular route.^{6,7} The **1:1000** concentration must be used for intramuscular or subcutaneous epinephrine administration; the dose may be repeated every 10 to 20 minutes.⁵ If the child does not respond to epinephrine that is administered via the intramuscular or subcutaneous route, *only then* should it be administered by slow intravenous bolus, at a dose of 0.01 mg/kg (0.1 mL/kg), using the **1:10,000** concentration. This dose may be repeated every 5 to 10 minutes.⁵

The low systemic vascular resistance and unevenly distributed blood flow that occur during the anaphylactic reaction create a relative hypovolemia that requires fluid replacement for stabilization. An initial isotonic fluid bolus (20 mL/kg) should be repeated as needed to correct hypotension and improve perfusion.

Second-line treatment for anaphylactic shock includes diphenhydramine, 1 to 2 mg/kg intravenously, to counteract the histamine-induced vascular dilation. Corticosteroids also can be considered.⁶

This patient received epinephrine in the pediatric ICU, was extubated within 24 hours of admission, and then discharged home with instructions to follow up with an allergist. The parents were advised not to apply egg to any burns or injuries that the baby might sustain.

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Submissions to this column are welcomed and encouraged. Submissions may be sent to one of the following:

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